Review: Effects of Imported Animals on Vegetation, New Zealand

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showing that the forest tends to replace itself, and among them are often species of *Oreomyrhis*, *Asperula*, etc., and many introduced weeds; here the largest beeches have a diameter of only about 6 inches, the trees doubtless replacing the primeval forest which was destroyed by fire about 30 years ago; the forest floor where otherwise bare is covered with beech leaves spread over a rich brown humus fairly free from stones, and abundant on it is *Veronica vernicosa*, with species of *Epilobium* and *Helichrysum* in more open spaces. On passing into the forest the introduced grasses disappear, the floor becomes damper and moss appears on it, with young beeches growing through; and as we reach the portions which cattle have not destroyed, the undergrowth becomes denser, while *Nothofagus cliffortioides* is mixed with, but never altogether displaced by, two other species of southern beech (*N. Menziesii* and *N. fusca*). The upper limit of the forest is about 1000 ft. above the bed of the valley, and the sides are often so steep as to be swept by stone avalanches which carry away the beech trees—their place is then taken by plants of the shingle-fan, but the beeches grow into this vegetation from the sides, and probably in course of time will reoccupy the whole area. (2) The upper portion of the Ada saddle is a flat open valley with English pasturage (cocksfoot and Yorkshire fog grasses, clover, sorrel, etc.) and southern beech (*N. cliffortioides*) forest similar to that described for the Ada valley some 500 ft. below. The head of the saddle is occupied by a *Sphagnum* bog about 200 yards square which divides the eastern and western watersheds and has a pond in its centre; the edges are fringed by species of *Dracophyllum*, *Podocarpus*, *Phyllocladus*, *Dacrydium*, etc.

EFFECTS OF IMPORTED ANIMALS ON VEGETATION, NEW ZEALAND

Aston, B. C. "Some effects of imported animals on the indigenous vegetation."
Proc. New Zealand Inst., **44**, 1912, Part i, pp. 19–24.

The author describes the ravages committed by imported animals on the native vegetation in various parts of New Zealand. Special attention is given to three areas in which the effects of such animals are particularly marked. Two of the areas are valleys consisting of extensive river-flats walled in by steep and heavily bushed mountains, the only natural outlet being a long winding gorge where the river issues into the plain. These valleys form natural sanctuaries for escaped cattle, wild pigs, horses, and rabbits, and their floras are rapidly changing in character owing to the attacks of the animals, which because of difficulty of access to the valleys are not kept in check by man. One effect of imported animals is that some of the more edible plants become restricted to situations beyond their reach, hence a species which is able to adapt itself to any station may by compulsion be restricted to one. For instance, *Lepidium oleraceum* has been eaten out along the Wellington coast and is now found only on inaccessible rock-faces; similarly the shrubby *Senecio Greyii*, though able to grow on any soil, has in some localities become limited, probably owing chiefly to goats, to situations which would lead the ecologist to class it as a chasmophyte; while a third common plant of littoral rock-faces is the grass *Agropyrum scabrum*, which is greatly relished by sheep and is consequently being eaten out on the central volcanic plateau of the North Island—in one district this species assumes the habit of a tussock-grass and is then better able to resist close cropping. Many interesting details are given by the author regarding the depredations of grazing animals on the vegetation of the sea-coast; for instance, in one locality the cattle laboriously drag themselves through the mud to reach the *Samolus repens* which covers the estuarine mud-flats.

Changes in the indigenous flora are also being brought about by means of the spread of exotic species the seeds of which are distributed by imported animals, especially by blackbirds, rats, and sheep. On extensive flats at an elevation of 3000 to 3500 ft., covered by pumice in which rabbits can readily burrow and of which they have taken possession in enormous numbers, it is difficult, owing to the ravages of these animals, to say what the original flora has been; apparently all the finer grasses have been eaten out and exterminated, and the rabbits have taken to attacking plants elsewhere immune from their depredations—for instance, piles of the leaves of shrubby *Veronicas* are seen near the bushes, the rabbits having nibbled the stalks and left the blades, while even harsh grasses like *Festuca rubra* are sometimes attacked, and the sole surviving native grass

(*Danthonia Raoultii*) is badly eaten, possibly by wild horses as well as by rabbits and pigs. The pigs are particularly destructive in many places, attacking especially plants with starchy rhizomes and bulbs; the native arrowroot fern (*Marattia fraxinea*) is being fast killed out by pigs on account of its large starchy rhizome, and these animals feed on fruits which are extremely poisonous and left alone by most other animals, though they cause partial paralysis of the hind legs in the pigs themselves. Omitting the grasses, the native plants which find most favour with herbivorous animals appear to be those belonging to the families Cruciferae, Umbelliferae, Araliaceae, Violaceae, Malvaceae, Tiliaceae, Rubiaceae, Primulaceae, Leguminosae, Chenopodiaceae, and in a smaller degree Compositae, Liliaceae, Juncaceae, and Cyperaceae; but doubtless many other non-poisonous native plants supply either normally or in times of scarcity food for animals. Cattle and sheep, though having their preferences, will eat most ferns, any shrubs, and the seedlings of forest trees when food is scarce; in small clumps of bush the undergrowth is sometimes completely destroyed.

AUSTRALIAN AND NEW ZEALAND MOSSES

- (I) **Brotherus, V. F., and Watts, W. W.** "The mosses of the Yarrangobilly Caves district, New South Wales." *Proc. Linn. Soc. New South Wales*, 1912, Abstract, p. 4.
- (II) **Dixon, H. N.** "On some mosses of New Zealand." *Journ. Linn. Soc., Bot.*, **40**, 1912, pp. 433—459.

These two papers are of interest from the phytogeographical standpoint, on account of their bearing upon the composition of the Australasian moss flora.

(I) An account of a large collection of mosses made in the Yarrangobilly Caves district, New South Wales; 10 new species are described, and of the species enumerated many are new to this colony. The chief feature of the collection is the evidence it supplies of affinity to the flora of Tasmania and to that of the Australian Alps. The geology of the district is dealt with.

(II) An account of mosses collected in the North and South Islands of New Zealand during the visit of the "Nimrod" of the British Antarctic Expedition (1907—9) and of others sent by various collectors from different parts of the islands. The moss-flora of New Zealand, like that of the higher plants, may be divided generally into three categories:—(1) Malay-Australian, (2) Endemic, (3) Antarctic-Fuegian. Assuming that species common to Tasmania (or Australia) and New Zealand have migrated from the former region to the latter, the author's list shows an addition of three species to the first category (exclusive of more or less cosmopolitan species here recorded for the first time) in plants hitherto known only from Tasmania or continental Australia. The five new species described form an addition to the extensive endemic flora of the Islands; while in two cases at least—the subgenus *Holodontium* (represented by the new species *Dicranum Mackayi*) and *Dicranoweisia antarctica*—we have a very interesting addition to the floral links between New Zealand and the Antarctic and Fuegian regions.

VEGETATION OF ISLE ROYALE, LAKE SUPERIOR

- Cooper, W. S.** "The climax forest of Isle Royale, Lake Superior, and its development." *Bot. Gazette*, **55**, 1913, pp. 1—44, 115—140, 189—235, 1 map, 55 figures.

This is an important study of the plant-covering of a large island in Lake Superior, now dominated by forest, and of the lines of succession leading up to the final or climax forest stage. The author has not only made excellent use of the various methods of ecological study followed by other investigators of the vegetation of a relatively small area, but has introduced various fruitful ideas regarding plant succession based upon his own detailed studies, besides developing and emphasising various concepts which have probably never before been worked out so carefully.